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# Single crystal fiber for laser sources

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## Summary (100 mots):

Single crystal fiber (SCF) is a hybrid laser architecture between conventional bulk laser crystals and active optical fibers allowing higher average powers than conventional crystals and higher energy than in fibers in pulsed regime. The pump beam is confined by the guiding capacity of the SCF whereas the signal beam is in free propagation. In this paper, we present an overview of the results obtained with SCF Er:YAG oscillators emitting at 1617 nm, SCF Nd:YAG oscillators emitting at 946 nm, a high power Yb:YAG SCF oscillator and pulse amplification experiments achieved with diode-pumped Nd:YAG SCF and Yb:YAG SCF.

## Abstract (250 mots)

Single crystal fiber (SCF) is a hybrid laser architecture between conventional bulk laser crystals and active optical fibers allowing higher average powers than with conventional crystals and higher energy than with fibers in pulsed regime. The pump beam delivered by a fiber-coupled laser diode is confined by the guiding capacity of the SCF whereas the signal beam is in free propagation. In this paper, we study the pump guiding in the SCF and give an overview of the results obtained using SCF gain modules in laser oscillators and amplifiers. We report about up to 500  $\mu$ J nanosecond pulses at the output of a passively Q-switched Er:YAG SCF oscillator at 1617 nm. High power experiments with Yb:YAG allowed to demonstrate up to 250 W out of a multimode oscillator. High power 946 nm Nd:YAG SCF oscillators followed by second and fourth harmonic generation in the blue and the UV is also presented with up to 3.4 W at 473 nm and 600 mW at 236.5 nm. At 1064 nm, we obtain up to 3 mJ with a nearly fundamental mode beam in sub-nanosecond regime with a micro-chip laser amplified in a Nd:YAG SCF. Yb:YAG SCF amplifiers are used to amplify fiber based sources limited by non-linearities with a narrow linewidth laser and with a femtosecond source. Using chirped pulse amplification, 380 fs pulses are obtained with an energy of 1 mJ and an excellent beam quality ( $M^2 < 1.1$ ).